POSTERS

TCT-643

Influence of cardiac motion on acquiring accurate measurements using Optical Frequency Domain Imaging (OFDI): Ex vivo study while heart beat and coronary flow being simulated

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Background: Length measurements using intravascular ultrasound (IVUS) is limited because its motorized pullback device assumes no cardiac motion. A newly-developed intracoronary imaging device, optical frequency domain imaging (OFDI), has higher resolution and auto pullback speed than IVUS. OFDI is probably less susceptible to heartbeat during pullback; however, it has not been fully investigated yet.
Methods: This study investigated 31 stent deployments at the mid left ascending arteries, the ex vivo silicon tubes. Each stent was deployed at normal pressure while heartbeat and coronary flow being simulated. The heart rate was set at 60/min. The length of the stent was measured using OFDI twice for its reproducibility of the measurements. Microscope (SLM) also measured the length of the stent; the differences in stent length between OFDI and SLM were assessed. Each stent length was measured at the pullback speeds of 10, 20, and 40 mm/sec, respectively, for evaluating the accuracy of the measurements at different speeds; totally, 186 pullbacks were investigated.
Results: The mean differences in stent length between OFDI and microscope were 0.414 mm for 10 mm/sec pullback speed, 0.182 mm for 20 mm/sec, and 0.069 mm for 40 mm/sec. Intra class correlation coefficient (ICC) were 0.985 (95% CI, 0.975-0.995) for 10 mm/sec, 0.994 (0.990-0.998) for 20 mm/sec, and 0.995 (0.991-0.998) for 40 mm/sec. The mean differences in two repetitive pullbacks were 0.026 mm for 10 mm/sec, 0.071 mm for 20 mm/sec, and 0.016 mm for 40 mm/sec. ICC were 0.995 (95% CI, 0.992-0.999) for 10 mm/sec, 0.996 (0.994-0.999) for 20 mm/sec, 0.996 (0.993-0.999) for 40 mm/sec.
Conclusions: In the ex vivo study while heartbeat and coronary flow being simulated, OFDI showed fewer errors in longitudinal measurements and higher reproducibility. Moreover, its accuracy and reproducibility were remarkable at a high pullback speed.

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Impact of Cigarette Smoking on the Coronary Plaque Composition Assessed by Integrated Backscatter IVUS

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Background: Cigarette smoking is known to be associated with atherosclerosis and to be an important risk of cardiovascular disease. The aim of this study was to evaluate the impact of cigarette smoking in coronary plaque composition by integrated backscatter (IB) intravascular ultrasound (IVUS).
Methods: A total of 143 consecutive patients undergoing PCI were enrolled. A history of past illness, including heart disease, stroke, and smoking habits were obtained by interview. Subjects were asked to note whether they were current smokers, had quit smoking or had never smoked. According to interview results, patients were divided 3 groups with never, past and current smokers. Gray scale and IB-IVUS tissue characterization analysis was evaluated. Three-dimensional analyses were performed to determine plaque volume and the volume of each plaque component (lipid, fibrous, and calcification).
Results: Gray scale analysis showed vessel and plaque area were not significantly different among 3 groups. IB-IVUS analyses indicated that the patients with current smoker group were significantly higher % lipid volume and lower % fibrous volume (ANOVA p=0.01 and p=0.04). Logistic regression analysis shows current smoking status (odds ratio 4.40, 95% confidence interval 1.20-16.23, p=0.03) and BMI (odds ratio 1.16, 95% confidence interval 1.02-1.33, p=0.03) were independently associated with the presence of lipid-rich plaque, defined as upper 75 percentile of study population.

Variable	Never smoker (n=49)	Past smoker (n=56)	Current smoker (n=38)	p
Male, %	35 (71.4)	52 (94.5)	37 (97.4)	<0.05
Age, yrs	70.9 ± 8.4	68.7 ± 8.0	68.5 ± 7.7	0.80
Hypertension	36 (73.4)	44 (78.6)	30 (78.9)	0.71
Diabetes mellitus	23 (53.1)	26 (46.4)	22 (57.9)	0.59
Reference diameter by QCA, mm	2.8 ± 0.5	2.9 ± 0.5	2.9 ± 0.5	0.94
IB IVUS analysis				
% fibrous volume, %	48.9 ± 12.3	45.9 ± 14.9	41.8 ± 11.8	0.04
% lipid volume, %	40.5 ± 14.8	45.9 ± 14.9	50.1 ± 14.7	0.01
% high signal volume, %	4.8 ± 4.2	2.8 ± 2.7	2.5 ± 1.9	0.25

Conclusions: Current smoking status is independently associated with lipid-rich plaques, contributing to the increasing risk of plaque vulnerability.

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Impact of Renal Dysfunction on Changes of Plaque Characteristics in Non-intervened Coronary Segments in Statin-Treated Patients with Angina Pectoris and Hypertension

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Background: It is not well known about the relation between renal function and plaque changes in patients with angina pectoris and hypertension who uses statins. We assessed the impact of renal dysfunction on changes of plaque charcteristics in statin-treated patients with angina pectoris and hypertension using virtual histology-intravascular ultrasound (VH-IVUS).
Methods: We assessed plaque changes between patients with CKD [n=81, estimated creatinine clearance (CrCl) <60 mL/min) and those without CKD (n=117) who underwent baseline and follow-up VH-IVUS for non-intervened intermediate coronary stenosis.
Results: %necrotic core (NC) area at minimum lumen area (MLA) site (22.5±11.7% vs. 19.0±11.1%, p=0.035) and %NC volume (20.3±8.0% vs. 15.8±9.4%, p=0.001) were significantly greater, and thin-cap fibroatheroma was observed more frequently (25.9% vs. 10.3%, p=0.004) in CKD group compared with non-CKD group. Follow-up VH-IVUS was performed in about 9 months after baseline VH-IVUS examinations. At follow-up, plaque was progressed in CKD group, in contrast plaque was regressed in non-CKD group [Δplaque plus media (P&M) area at MLA site: +0.41±0.72 mm2 vs. -0.78±0.64 mm2, p<0.001). The CrCl correlated with ΔP&M area at MLA site (r=-0.538, p<0.001) and Δ%NC area at MLA site (r=-0.167, p=0.019). CrCl (OR 0.901, 95% CI 0.867-0.936, p<0.001) and baseline %NC area at MLA site (OR 1.251, 95% CI 1.116-1.403, p<0.001) were the independent predictors of plaque progression at follow-up.
Conclusions: In patients with angina pectoris and hypertension who uses statins, renal dysfunction is associated with plaque progression and increase of NC component at follow-up.

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Higher-risk plaque features are associated with increased structural stresses in patients that present with an acute coronary syndrome

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Background: Autopsy studies demonstrate that the majority of myocardial infarctions are due to rupture of thin-cap fibroatheroma (TCFA). Nevertheless in-vivo prospective studies using virtual-histology intravascular ultrasound (VH-IVUS) show that <5% of VH-defined TCFAs ruptured at follow up. Additional markers of plaque instability are therefore required to refine the ability of VH-IVUS to predict plaque rupture.
Methods: VH-IVUS imaging was performed prior to PCI in the culprit left anterior descending arteries of 53 patients (23 ACS, 30 stable angina). Finite element analysis was performed on 4,429 frames, identifying 99,584 individual plaque components. Normalized maximal principal stress (Stress-P1) was calculated throughout whole vessels, stented plaques and higher-risk regions (plaque burden (PB) ≥70%, minimal